

# Cognitive Neuroscience

PSYC 1230 / NRSC 2249

Fall 2023

Lectures: Mondays and Wednesdays 10:15 am - 11:44 am, ANNS110

**Instructor:** Prof. Allyson Mackey

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## **TAs:**

Yufan Ye

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## **Course Description**

How does brain give rise to mind? How does biology support thought? We will explore these fundamental questions in this course. In the first part, we will discuss the anatomical building blocks of the brain. In the second part, we will examine the methods scientists use to link anatomy to the mind. In the third part, we will explore the neural underpinnings of specific mental processes such as perception, action, memory, emotion, and cognitive control. Finally, we will discuss the applications of cognitive neuroscience to education, law, medicine, and technology.

## **Natural Science Across the Disciplines Sector**

Cognitive Neuroscience combines questions and methods from two scientific disciplines: Psychology and Neuroscience. Further, understanding methods in Cognitive Neuroscience requires a high-level understanding of principles from physics like electricity and magnetism. This course requires quantitative reasoning, including data visualization and statistics. At the end of the course, you will learn how cognitive neuroscience can be applied to societal issues, like age of adulthood, psychiatric diagnosis and treatment, and education policy.

## **Textbooks**

M.C. Diamond, A.B. Scheibel, L.M. Elson (1985). The Human Brain Coloring Book. (ISBN 0-06-460306-7).

M.S. Gazzaniga, R. Ivry, & G.R. Mangun, (2019). Cognitive Neuroscience: The biology of the mind. **Fifth Edition**. New York: W. W. Norton & Company, Inc.

## Course Web Page

Announcements, lectures, additional readings, and other important course information will be posted routinely on Canvas. Please monitor this website regularly.

## Prerequisites

It is helpful to have background knowledge of Psychology (e.g., Introduction to Psychology, PSYC0001) or Neuroscience (e.g., Introduction to Neuroscience, PSYC1210), especially in the first few weeks of the course. Prerequisites are not formally enforced.

## Course Policies and Requirements

Syllabus: Read this syllabus! It is your primary source of information about the policies and schedule of the course. We will expect you to be familiar with this information.

Lectures: This course is taught in a lecture-based format. You are encouraged to interrupt the lecture frequently with questions. If there is something that you do not understand in class, speak up! It is likely that many of your classmates do not understand it either.

If you want to do well in the class, it is best to attend the lectures. Lecture slides will be posted on Canvas before the lecture. Lecture recordings, consisting of audio and images displayed through the projector, will be available on Canvas. However, these materials will not capture in-class activities and some practice exam questions. Therefore, these materials are only part of the lectures and may not fully convey the information that was presented.

Bring a pen and paper with you to every class as I will sometimes ask you to complete activities in class. I also will draw on the board, and will ask you to draw along with me.

Readings: You are expected to read the assigned portions of the textbooks, along with any additional readings posted to Canvas. Focus on the topics presented in lecture. Make sure that you fully understand all of the figures from the book that I show in lecture, and read through the practice questions at the end of each chapter.

Polls: I will occasionally give practice questions as part of the lecture. This lets me check your understanding, and it lets you know whether you are keeping up. Questions will be displayed at **PollEv.com/mackey**. You will be able to answer with a laptop or smart phone. Although there is not a formal participation grade for this class, frequent participation will be considered for borderline grades. You will get an e-mail with instructions on how to register. **Make sure you are signed in before responding to questions.** If you forget to sign in, there is no way to trace your response to your name.

Questions: The best way to get your questions answered is during lecture. We will be available after lecture for a few minutes, but there will be a course directly after ours. If you can't come to any of our office hours, please let us know, and we will try to adjust the schedule. You may also e-mail us course related questions. If you choose e-mail, please **copy the entire teaching team** (the professor and all TAs), and one of us will get back to you **within 24 hours**. We will cut off questions at 9 pm the nights before exams. If we find that many students have the same question, we will post the question anonymously, along with the answer, on Canvas.

## Grades

There are 200 points available for this course:

- 3 exams, each worth 40 points, or 20% of your grade
- 1 lab, worth 60 points, or 30% of your grade
- 1 research participation or response paper, worth 20 points, or 10% of your grade.

Exams: Exams will be a mix of multiple choice, short answer, charts/diagrams, and essay questions. A good way to study for the exams is to complete the weekly study guides that the TAs will post to Canvas on Thursdays. Answers will be posted on Fridays. Please complete questions before looking at the answers.

### Exam reviews sessions:

- Exam 1: Tuesday September 26<sup>th</sup> at 6pm on Zoom
- Exam 2: Thursday October 26<sup>th</sup> at 6pm on Zoom
- Exam 3: In class on December 6<sup>th</sup>

Lab Exercise: You will use neurosynth.org to explore brain connectivity and the cognitive neuroscience literature. We will reserve one class period to work on this lab together. Please bring a laptop or find another student to work with. If you don't have access to a computer, please e-mail the teaching team and we will find one for you to borrow.

Research Participation and/or Response Papers: For this assignment, you will be exposed to the types of research being conducted at Penn, and the methods used to answer these questions. This requirement is due December 6th to Canvas. Please choose **ONE** of the following:

- Research Participation:*** Participate in research happening at Penn. Detailed directions will be posted on Canvas within the first 2 weeks of class. Participating in research gives you a better sense of how knowledge is gained in Cognitive Neuroscience. You must submit a brief description of the experiment(s) you participate in and relate them to topics discussed in the course (no more than 250 words total). You must earn TWO experiment credits. Multiple experiments are fine.
- Research talk response paper:*** Attend ONE neuroscience, cognitive science, or psychology research talk on campus and write 250-word summary and analysis. I will keep a list of suitable talks on Canvas. You may also propose a talk to me for approval. Your write up should include a brief summary of the research presented (methods, findings, etc), and you should also relate the work presented to topics and methodologies learned in this course. **Please include a photo of yourself at the talk.**

Make-Up Policy: We can accommodate make-up exams for illnesses, family emergencies, and religious holidays. Please look at the dates for the exams now. If any exam conflicts with a religious holiday that you observe, you must let the teaching team know by e-mail by the end of the second week of the course.

Late lab policy: No extensions will be given on the lab. Your lab grade will be docked 2% for every day that it is late.

Re-grading Policy: If you have a question or concern that there was an error in grading an exam, you must submit your request to the teaching assistants in writing to have the exam regraded, no more than one week after the exam was returned in class. No regrade requests will be considered beyond this date. Your request must explain the specific error that you

think was made. If you submit a request, the exam will be regraded in its entirety, and the final grade might be higher or lower than your original grade. Please only submit a re-grade request if you genuinely believe that an error has been made--a judgment call that could have gone either way is not an error. Please note that exams written in pencil will *\*not\** be regraded. Further, a subset of **exams will be photocopied**, so please do not make changes after the exams are returned.

#### Technology Policy:

Cell phones need to be on silent and stowed away during lectures unless you are responding to an in-class question. Please let us know if you have personal reasons that prevent you from following this rule.

Be considerate about your use of technology in the classroom. Turn off all alerts and sounds that might distract other students.

Studies have shown that attention is lost when students switch between tasks (social media, email, etc.) while taking notes on laptops, and test performance was significantly lower for students who used e-mail, chat programs, or social media during class than for students who did not. Moreover, it is distracting for your fellow students if you are accessing e-mail or online in class.

Academic Integrity: Please note that Penn has strict rules on academic integrity (see [www.upenn.edu/academicintegrity](http://www.upenn.edu/academicintegrity)). Violations of the rules will be reported to the Office of Student Conduct and will likely result in automatic failure of the course.

Important dates: The drop deadline is October 9th. The withdraw deadline is November 6<sup>th</sup>.

<b>Monday</b>	<b>Wednesday</b>
	August 30 Lecture 1 Introduction & brain cells HBCB 1-2, 1-3, 1-5, 1-6, 2-1 to 2-6
September 4 No class, Labor Day	September 6 Lecture 2 Spinal cord & brainstem HBCB 4-1, 4-4, 4-9, 5-1 to 5-3
September 11 Lecture 3 Cerebellum HBCB 5-13, 5-14, 5-15	September 13 Lecture 4 Limbic System HBCB 5-26, 5-27, 5-28
September 18 Lecture 5 Basal ganglia HBCB 5-24, 5-25	September 20 Lecture 6 Cortex HBCB 5-29 to 5-33 Anatomy Synthesis: HBCB 5-35 to 5-48

September 25 Lecture 7 Methods of Interference Gazz pgs. 79-92	September 27 <b>Exam 1 (Anatomy, Lectures 1-6)</b>
October 2 Lecture 8 Structural & functional MRI Gazz pgs 93-95, 106-108, 111-116	October 4 Lecture 9 Electrophysiology & EEG Gazz 96-103
October 9 Lecture 10 Sensation & Perception Gazz Chapter 5 <b>Exam 1 returned</b>	October 11 Lecture 11 Visual Perception & Object Recognition Prof. Michael Arcaro Gazz Chapter 6
October 16 Lecture 12 Attention Dr. Arielle Keller Gazz Chapter 7	October 18 Lecture 13 Action Dr. Mac Woodburn Gazz Chapter 8
October 23 Lecture 14 Memory Liz Siefert Gazz Chapter 9	October 25 Lecture 15 Emotion Gazz Chapter 10
October 30 <b>Exam 2 (Lectures 7-15)</b>	November 1 <b>Neurosynth Lab Work Day</b>
November 6 Lecture 16 Language Gazz Chapter 11	November 8 Lecture 17 Cognitive Control Gazz Chapter 12, pgs. 515-526
November 13 Lecture 18 Decision Making Gazz Chapter 12, pgs. 526-538 <b>Exam 2 returned</b>	November 15 Lecture 19 Social Cognition Yufan Ye Gazz Chapter 13
November 20 Lecture 20 Cognitive Neuroscience & Technology <i>Readings on Canvas</i> <b>Neurosynth Lab Due</b>	November 22 (Thanksgiving)

November 27 Lecture 21 Cognitive Neuroscience & Law <i>Readings on Canvas</i>	November 29 Lecture 22 Cognitive Neuroscience & Mental Health <i>Readings on Canvas</i>
December 4 Lecture 23 Cognitive Neuroscience & Education Yijin Hu <i>Readings on Canvas</i>	December 6 Summary and Review <b>Research participation/  Responses due</b>
December 11 <b>Exam 3 (Lectures 16-23)</b>	